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Urinary Retention after Orthopedic Surgery

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Abstract

Urinary retention is a common complication of post-surgery and anaesthesia and is commonly known as Post-operative Urinary Retention (POUR). The risk of retention is especially high following anorectal surgery, hernia repair, and orthopedic surgery and increases with advancing age of the patient. Many factors are thought to contribute to the development of POUR including traumatic catheterization, pre-existing urologic pathology, and increased fluid requirements of surgery combined with the use of analgesics, opiates and components of anaesthesia The regular capacity of the bladder ranges between 400-600 cc, with the first signal of micturition occurring when the bladder capacity is at 150 cc to the feeling of fullness when to capacity reaches 300 cc. The sensation of fullness occurs at a certain level of afferent activity. Once the voluntary signal to begin voiding has been issued, neurons in pontine micturition centre fire maximally causing the wall of the bladder to contract via the stretch receptors in the bladder. Consequently, the parasympathetic neurons are activated leading to the contraction of the detrusor muscle and relaxation of the bladder neck resulting in micturition. Hindrance to these pathways can accelerate the likelihood of developing POUR. Conservative measure are needed to assist the patient to pass urine, else the bladder will need to be drained using either an intermittent catheter or an indwelling urethral catheter. While there exists little information concerning the outcome of retrospective studies on POUR, this particular review sheds new light on the management strategies and risk factors for the development of POUR after orthopedic surgery to prevent the long-term consequences of this complication.

Keywords: Orthopedics; Surgery; POUR; Urinary retention

Introduction

Postoperative urinary retention (POUR) or the inability to void after surgery is a well-recognized complication of any surgical procedure, with an overall incidence ranging from 4% to 25% [1]. Though most common after pelvic surgery, it is well known that POUR is one of the more common complications following orthopedic surgery.

Normal bladder capacity ranges between 400 to 600 ml, with the first signal to void beginning at approximately 150 ml of filling and the feeling of fullness at 300 ml of filling. The sensation of fullness occurs after activation of the stretch receptors in the bladder. This in turn activates the parasympathetic neurons leading to the contraction of the detrusor muscle and relaxation of the bladder neck resulting in micturition [2,3]. Interference with these pathways can increase the likelihood of developing POUR.

Many factors are thought to contribute to the development of POUR including traumatic catheterization, pre-existing urologic pathology, and increased fluid requirements of surgery combined with the use of analgesics, opiates and components of anesthesia [3,4]. The latter factor may contribute to bladder overdistention, diminished awareness of bladder sensation, decreased bladder contractility, and decreased micturition reflex activity. Further, post-operative pain and discomfort may contribute to a nociceptive inhibitory reflex that may affect bladder contractility, outlet resistance, and decreased micturition reflex activity [5].

POUR has been associated with increased hospital stay, patient discomfort, and urinary tract infections [5]. If left untreated patients with POUR face the risk of developing detrusor damage and subsequently atonic bladder. In fact, POUR has been associated with a higher fatality after proximal femoral fracture. Smith et al. studied POUR in women over the age of 65 admitted to their institution for the surgical repair of proximal femoral fracture from 1990 to 1991 [4]. Post void residual volumes were obtained upon admission to the hospital utilizing an ultrasound bladder scanner. Mean post void residual on admission was 120 ml. The authors also assessed factors that may be associated with morbidity in general such as older age group, impaired mental test score, and mobility score. They found that after the mental test score, increased POUR volume was the second most significant risk factor for fatality consistently over the 30 months postoperative follow up. This finding was attributed to the suggestion that increased residual volume may be a marker of overall poor health.

The literature on POUR has been consistent but sparse over the past four decades. Further, the few more recent publications reported outcomes of retrospective studies. In order to shed

new light and to prevent the long-term consequences of this complication, we reviewed the management strategies and risk factors for the development of POUR after orthopedic surgery over the past four decades.

Risk Factors Associated with the development of POUR

In 2007 Lingaraj et al. from Singapore conducted a retrospective study in order to identify risk factors for urinary retention [6]. The authors studied 125 consecutive patients undergoing primary total knee arthroplasty. Of the patients studied, 109 were female and 16 were male, with average age of 67.5 years old. Of these, 10 patients developed POUR, 6 male and 4 female. The only risk factors found to be associated with POUR were male sex and postoperative use of epidural anesthesia. Unfortunately, the limitation of this study was its small size, particularly with respect to the male cohort.

In 2014 Sung et al. from the Republic of Korea performed a large, well powered, multicenter, retrospective study which the risk factors associated with POUR after orthopedic surgery [7]. The authors collected data on 19,079 patients, 7798 males and 7883 female, with a mean age of 45.2. POUR developed in only 2.3 % (365), 154 male and 211 female. They found that older age, male sex, joint replacement surgery, and history of hypertension and diabetes mellitus were associated with an increased risk of POUR.

Gandhi et al. published a retrospective study looking at patient and surgical factors that were associated with the development of POUR after lumbar spine surgery [8]. This 2014 study included a total of 647 patients, 333 of which were male and 314 female, with an average age of 56. Thirty-six patients (5.6%) developed POUR. Risk factors found to be associated with developing POUR after lumbar surgery were male sex, BPH, diabetes, and depression. Interestingly they found that tobacco use was protective against developing POUR.

Most recently in 2016, Altschul et al. performed a retrospective study of 397 patients (117 male, 180 female) undergoing elective spinal surgery [9]. A total of 35 patients (8.8%) developed POUR. This study uniquely controlled for the presence of BPH and found that female sex was associated with development of POUR. Other risk factors that were found to be associated with development of POUR included history of BPH, previous urinary retention, constipation, increased operative time, and postoperative PCA usage.

Treatment and Identification of Urinary Retention after Orthopedic Surgery

In the 1980's a number of orthopedic surgeons advocated the use of bladder decompression post-operatively to preempt POUR. Michelson et al. published a randomized controlled trial of 100 patients after hip or knee replacements [10]. Patients were randomly assigned to Group 1, in which patients were catheterized in the operating room and catheters were removed the following morning, or Group 2, in which intermittent catheterization was performed post-operatively as needed. After catheter removal, the patients in Group 1 had a statistically significant lower incidence of POUR than those in Group 2 (27% *vs.* 52%). Further, bladder overdistention (defined as >700cc) occurred in 45% of patients in Group 2 as opposed to 7% in Group 1. ($P<0.01$) This was found to be associated with an increased need for long-term catheterization. Rates of urinary tract infection between the two groups were similar (11% *vs.* 15%). Risk factors of preoperative urinary symptoms, previous urinary tract surgery, previous urinary tract infection, previous urinary retention, high-risk medical conditions, sex, type of anesthesia, and age were assessed and none were found to be associated with POUR. The authors concluded that the use of a short-term indwelling catheter after joint replacement surgery results in a reduction in the incidence of POUR and bladder overdistention without increasing the incidence of urinary tract infection.

In 1988, Carpiniello et al. also advocated keeping the bladder decompressed for a 24 h period post operatively to prevent over distention of the bladder and urinary retention [11]. They conducted a prospective, randomized controlled study that looked at risk factors for POUR in 77 elderly female patients with total joint replacement. The patients were randomized into three group; in Group A (n=31) the patients underwent straight catheterization in the recovery room, in Group B (n=23) the patients did not undergo catheterization in the recovery room, and in Group C (n=23) the patients had indwelling foley catheters placed preoperatively which were removed 24 h later. None of the patients in the Group C developed POUR and only one patient developed a post operative urinary tract infection. The authors' statistical analysis of Group A and B revealed no significant differences in mean straight catheterization volume, need of foley catheter, or incidence of positive urine cultures post operatively and therefore grouped them together. In this combined group they found that 13% of these patients required the insertion of a catheter for POUR, and 10% had positive urine cultures postoperatively.

Skelly et al. collected data on 76 patients undergoing surgical repair of hip fracture between 1986 and 1987 [12]. Thirty-five patients had an indwelling catheter post operatively for 48 h and 32 patients underwent intermittent catheterization every 6 to 8 h post operatively. A post void residual of less than 150 ml on two separate occasions was considered to be satisfactory voiding. Satisfactory voiding was resumed earlier in the intermittent catheterization group (5.1 days *vs.* 9.4 days). The authors attributed the divergence of their findings from the Carpiniello study to their scheduled regimen of post-operative intermittent catheterization. Another possible factor that may have contributed to the difference may be that the catheter was left indwelling for 48 h rather than 24 h as in the Carpiniello study. Interestingly, when assessing baseline characteristics of the patients who underwent catheterization to manage POUR, their female patients were four times as likely as their male patients to require catheterization.

Kumar et al. investigated the rates of urinary retention following total knee arthroplasty with a retrospective review of 142 patients (74 female, 135 male) undergoing total knee

arthroplasty between 2000 to 2002 [13]. In this cohort, only patients who could not void postoperatively, had a palpable bladder, or had significant bladder discomfort were catheterized. POUR was identified in 30 patients (21%). Higher post-operative morphine requirement and prior history of POUR were found to be risk factors associated with POUR.

In 2011 Balderi et al. from Montreal Canada studied the use of bladder scanners to detect POUR following joint arthroplasty [14]. They set out to assess the utility of bladder scanners to decrease the risk of the long term sequela of POUR, but performing a retrospective analysis of 286 consecutive patients undergoing hip and knee arthroplasty, 105 males, and 181 females. They assessed bladder volumes using a bladder scanner every 3 h in the post-operative phase, and defined POUR as a bladder volume of more than 500 ml. Of their total patients 73 (25%) developed POUR.

Kort et al. published a retrospective cohort study, which collected data from 803 patients undergoing hip or knee arthroplasty, 638 of which were analysed [15]. They defined POUR as the inability to void spontaneously with a bladder volume greater than 600 ml detected by bladder scan. Bladder volumes were monitored pre-operatively, immediately post operatively in the recovery room, and every 3 h thereafter. When the bladder volume exceeded more than 600 ml with the inability to void spontaneously, an indwelling catheter was inserted. They found that the incidence of POUR was 12.9% (n=82) when using their definition. Patients with a bladder volume of greater than 200 ml in the recovery room on the first post-operative bladder scan were at greatest risk of developing POUR. Gender, age, BMI, ASA classification, pre-operative bladder volume, type of anesthesia, type of arthroplasty and perioperative fluid administration were not identified as risk factors.

Conclusion

POUR is a well-known complication of orthopedic surgery that has potentially serious outcomes. The studies to date looking at the management of this complication support early bladder decompression, as opposed to waiting until over distention occurs. It remains unclear that male sex is a risk factor for development of POUR when controlling for BPH. There is suggestion that in fact female sex may be a risk factor for development of POUR. In order to successfully treat and prevent this complication and its long-term sequelae, more highly powered, prospective randomized-controlled studies need to be performed to identify the optimal post operative protocol and to identify the patients that are at highest risk for its development.

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